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Apparatus and Method for Handling Lead-Frame.

Field of Invention:

This invention relates to an apparatus and the method thereof to handle lead-frames during the process of semiconductor manufacture when the lead-frame has to be positioned with precision and specifically during the process of product marking to an array of integrated circuit (IC) chips attached to the lead-frame.

Background to the invention:

In the manufacture of IC chips, thin metal foils are often used to form leads, wire bonding process being used to bond the die obtained in the dicing process to the lead-frames. Other process may include a molding process for hermatically encapsulating the chip in a thermosetting resin; a product marking process; and a lead shaping process. A typical lead frame may contain from a few units of chips to a few tens in a given array. The substrate metal foil typically range from 0.3mm to about 0.5mm in thickness, and can be of a wider range than that specified.

Lead-frames are also provided with index points in the form of holes prepunched at a certain spacing accurately to the left and right of the strips lengthwise. This is common standard practice in the semiconductor industry. These index holes are useful reference points at various stages of manufacture. The left series of holes may lead the right series, whereby a vision camera can detect if the orientation of the lead-frames is in the right direction.

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As described above, the lead-frames are transported to different stations which may not be in-line. After a specific process is performed, the lead-frames may be stacked in magazines, typically containing 20 or more sheets of lead-frames. For the next stage of manufacture, the magazine is loaded to the input station of a handler, elevated to position and rolled out of the magazine to be buffer feed onto a lead-frame input track using a pick and place method.

The input track acts as a guide and typically has two linear and parallel rails having shoulders on which the lead-frame rests lengthwise thereby providing support for travel to the next process station. The track is typically width adjustable to cater for a plurality of sheet widths that could be used in the manufacture of the lead-frames. Width adjustment typically uses programmed servos. The input track provides guide to the path in the feed direction in which is horizontal to the input track.

Lead-frames, being thin foils, are prone to distortion at the edges particularly lengthwise after several stages of manufacture, then become wavy and the index holes become out of register with each other. Also, the lead frames may have to be fed into slotted rails, with very small tolerances. The process is similar to threading a needle. When kinks appear in the lead frame, jamming of the feed can occur and this may result in damaged lead-frames. This is costly and inefficient to the manufacture of the IC Chips.

In conventional input tracks, rubber pinch rollers move against the track which is lined with rubber strip to straighten the feed as the lead-frame strips are fed into the eye of the slotted rails.

This again is inefficient and time consuming and may also damage the lead-frame strips.

Summary of the Invention:

According to a first aspect of the invention, there is provided an apparatus for handling lead frames for use in the manufacture of IC Chips, which includes a means to place the said lead frame to a first position of an input track, an input track including a pair of spaced, parallel rails having opposed generally, having outwardly facing, L-shaped portions defining a pair of co-planar surfaces for supporting edge portions of the lead frames and a pair of upright surfaces forming a guide for the leads frame as it is positioned on the supporting surfaces, characterised in that the rails are mounted for contra rotation between the lead frames supporting position and a lead frame holding position in which the edges of the lead frame are received in the apex of the angle between the arms of the 'L' shaped portions.

According to a second aspect of the present invention, a method for flattening a lead frame during transfer from one stage of a manufacturing process to another in an apparatus according to the first aspect is provided.

As a result of the turning action of the rails from the lead frame supporting (first position) to the lead frame holding (second) position, the lead-frame held by the apparatus may be precisely positioned to proceed to the next processing station.

Surprisingly, the turning action may also assist straightening of the lead-frame by controlling waves, kinks and distortions before proceeding to the next station. The retaining pressure applied lengthwise by the rails on the lead-frame may be sufficient to mechanically straighten the lead-frame so that it can easily be fed to the next station.

Preferably the angle between the frame supporting surface and the upright surface of the 'L' shaped portion is greater than 90° to form a funnel into which a lead frame may be more easily

introduced.

Preferably the angle is about 120°. In the second position the lead frame preferably bisects the angle so that when the angle is 120° the rails may be rotated through 60° from the first to the second position, one rail may be rotated clockwise and the other anticlockwise.

The means for feeding the lead frames to the input track is preferably a pick-and-place mechanism.

The apparatus of the invention preferably also includes an optical sensor which is able to check the presence of a lead-frame after the leadframe has been placed on the input track.

The preferred method used in the apparatus to move the rails between the first and second positions involves the use of cams motivated by mechanical means.

Preferably, cam means is linked to each rail by a camshaft, which in turn is linked to cam rollers guided by a common cam follower housing.

Brief description of Drawings:

The invention will be described in further details by way of example with reference to the drawings in which:-

Figure 1 shows a general perspective view of the apparatus;

Figure 2 is a perspective view of the input track arrangement;

Figure 3 is an elevation showing the input track in its frame supporting position;

Figure 4 is an elevation showing the input track in its frame holding position;

Figure 5 is a flow chart of the method relating to the invention

Detailed Description of the Invention:

As shown in the drawings, a lead-frame handling apparatus comprises two parallel and linear rails (21) together making an input track (20), each connected to a cam means comprising a cam shaft (14), a cam follower holder (19), cam roller (15) and cam follower housing (12). The other end of the input track is connected freely to a bearing housing (16). The direction of the feed movement is towards the bearing housing (16).

A frame-lead (1) is picked and placed from a buffer supply of lead-frames (not shown) by vacuum device (5) onto the input track (20) as shown in Figure 1. The position of the input track (20) when at this point is as shown in Figure 3. When the presence of the lead-frame (1) is detected by means of through beam optical sensors (18), the vacuum supply is turned off. The left bar and right bar (21) of the input track is provided with a similarly machined profile as shown in Figure (3), each rail has an upright surface (22) and a frame supporting surface (23) at 120 degrees angle (24) to each other. Other angles may be used to achieve the same result.

The operation of the apparatus will now be described with reference to Figure 5. Initially the input track (20) is in the frame supporting position shown in Figure 3. A strip of lead-frame (1) is ready to be picked and placed using vacuum device (5). The lead-frame (1) is placed on the input track (20). The vacuum supply is switched off. Sensor (18) detects lead-frame (1) and the input track (20) is rotated to its frame holding position as shown in Figure 4.

The lead-frame, when retained at the frame holding position bisects the angle between the surfaces (22 and 23) and is void of kinks and waves such that it is ready to be mechanically pushed into positioning track (7) where, for example, a marking process can commence.

Claims:

1. Apparatus for handling lead frames for use in the manufacture of IC Chips, which includes a pick and place means to place the said lead frame to a first position of an input track, an input track including a pair of spaced, parallel rails having opposed generally, having outwardly facing, L-shaped portions defining a pair of co-planar surfaces for supporting edge portions of the lead frames and a pair of upright surfaces forming a guide for the leads frame as it is positioned on the supporting surfaces, characterised in that the rails are mounted for contra rotation between the lead frames supporting position and a lead frame holding position in which the edges of the lead frame are received in the apex of the angle between the arms of the 'L'-shaped portions.

2. Apparatus according to claim 1 in which the angle between the arms of the L-shaped portions is greater than 90°.

3. Apparatus according to claim 2, wherein the angle between the arms of the L-shaped portions is not greater than 120°.

4. Apparatus according to any one of claims 1 to 3, wherein the rails are rotatable such that in the lead frame holding position, the plane of the lead frame bisects the angle between the arms of the L-shaped portions.

5. Apparatus according to claim 4, wherein the angle between the arms of the L-shaped portions is 120° and rails are rotatable through 60°.

6. Apparatus according to any one of claims 1 to 5, wherein cam means and a cam shaft is provided to effect rotation of the rails.

7. Apparatus according to any one of claims 1 to 6, including

sensor means for detecting the presence of a lead frame on the rails when the rails are in the lead frame receiving position and for actuating the means for rotating the rails.

8. Apparatus according to any one of claims 1 to 7, including a pick-and place mechanism.

9. A method for flattening a lead frame during transfer from one stage of a manufacturing process to another which comprises introducing a lead frame into an apparatus according to any one of claims 1 to 8 in the lead frame supporting position and rotating the rails to the lead frame holding position.